PERIODONTAL LIGAMENTS

Functions of Periodontal Ligaments

The functions of periodontal ligaments are

1. Physical functions
2. Nutritional & Sensory
3. Formative and remodeling.

Physical Functions

1. Promotion of a soft tissue casing to protect the vessels and nerves from injury by mechanical forces.
2. Transmission of occlusional forces to the bone.
3. Attachment of teeth to bone.
4. Maintenance of gingival tissue in their purpose relationship to the teeth.
5. Resistance to the impact of occlusional forces (Shock absorption).

Transmission of occlusional forces to the bone.

The arrangements of the principal fibers are similar to suspension bridge or a hammock.

- When an axial force is applied to a tooth, a tendency towards displacement of the roots into alveolus occurs.
- The oblique fibers after their wavy, untested pattern, assume their full length and sustain the major part of the axial force.
- When a horizontal or tipping force is applied, two phases of tooth movement occurs.
    - First is within the confines of periodontal ligament.
    - Second produces a displacement of facial and lingual boney plates

The both rotate about an axis that may change as the force is increased.

- Apical position of the root moves in a direction opposite to the coronal portion.
- In areas of tension, the peripheral fibers are tact rather than wavy.

- In areas of pressure the fibers compressed, the tooth is displaced; a corresponding distortion of bone exists in the direction of root movement.

- In single rooted teeth, the axis of rotation is located in the area between the apical third and the middle third of the root.
  The periodontal ligament is narrowest in the region of the axis of rotation.
- In mutto-rooted teeth, the axis of rotation is located in the bone.
  In complain with the physiologic mesial migration of tooth, the periodontal ligament is thinner on the mesial root surface than on distal surface.

Resistance to the impact of occlusal forces (Shock absorption).

Two theories:

- Tensional Theory
- Vasoelastic theory.

1. Tensional Theory

It states that the principle fibres of periodontal fibers are the major factors in supporting the tooth and transmitting forces to the bone.

When a force is applied to the crown, the principle fibres first unfold and straighten, then deformation of the boney socket. When the alveolar bone has reached its limit, the load is transmitted to the basal bone.

2. Vasoelastic System Theory

It starts that the tooth is largely controlled by the fluid movement, with fibres having only secondary role. When forces are transmitted to the tooth, the extra cellular fluid passes from the periodontal ligament into the narrow spaces of bone through foramina in the cribriform plate.

These foramina are more abundant in cervical third. After depletion of tissue fluids, the fiber bundles absorb the slack and tighten →blood vessel stenosis. Arterial blood pressure causes ballooning of vessels and passage of blood ultra filtrates into the tissues, there by replenishing the tissue fluid.

Formative and remodeling functions

- Periodontal ligaments and alveolar bone cells are exposed to physical forces in response to mastication, parafunction, speech, and orthodontic tooth movements.
- Cells of periodontal ligaments participate in the formation and resorption of cementum and bone during physiologic tooth movement, in the accommodation of periodontium to occlusal forces and in the repair of injuries.
- These cells have a mechanism to respond directly to mechanical forces by activation of various mechano sensory signaling system including a denylate cyclase, stretch activated ion channels and by changes in cyto skeletal organization.
- Mitotic activity can be seen in fibroblastic and endothelial cells.

- Radioautographic studies.
  - With radioactive thiamidine, proline and glycine →High turnover rate of collagen in periodontal ligament.
  - Twice as fast in gingiva, 4 times as fast as skin
  - Rapid turnover of glycosaminoglycans in cells and amorphous ground substance also seen.

Nutritional and sensory functions

- Supplies nutrition to the cementum bone and gingiva by many of blood vessels and also provides lymphatic drainage.
- Capable of transmitting tactile, pressure and pain sensation by the trigeminal pathways.

Nerve bundle enter through periapical area

↓

Divide into single mylinated fiberes

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Lose their myelin sheath.

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Neural transmission

Free endings	Riffini Like	Meissner Corpuscles	Spindle Like
Tree like Pain Sensation . .	Mechanoreceptors Apical areas	Mid root region	Pressure & vibration Surrounded by a fibrous capsule Apical area

Classification of Cementum

Cementum is the calcified, avascular mesenchymal tissue that forms the outer covering of anatomic root.

Classification of cementum (Schroder)

1. **Acellular Afibrillar Cementum (AAC)**
   - Contains neither cells nor extrinsic or intrinsic fibers
   - Only mineralized ground substances.
   - AAC is a product of cementoblasts.
   - Found as coronal cementum in humans.
   - 1 - 15µm thick.
2. **Acellular extrinsic fiber cementum (ARFC)**
   - Contains densely packed bundles of Sharpey's fibers
   - Lack of cells
   - Product of fibroblasts and cementoblasts.
   - Found in cervical 3rd of the root, may extend further apically.
3. **Acellular mixed stratified cementum (AMSC)**
   - Extrinsic (Sharpey's) and intrinsic fibers and cells
   - Product of fibroblasts and cementoblasts.
   - Seen on apical third of roots and apices in furcation areas.
4. **Cellular intrinsic fiber cementum**
   - Contains cells but no extrinsic fibers
   - Formed by cementoblasts.
   - Fills resorption lacunae.
5. **Intermediate cementum**
   - Poorly defined zone near the cemento-dentinal junction of certain teeth that appears to contain cellular remnants of Hertwigs sheath embedded in calcified ground substances.